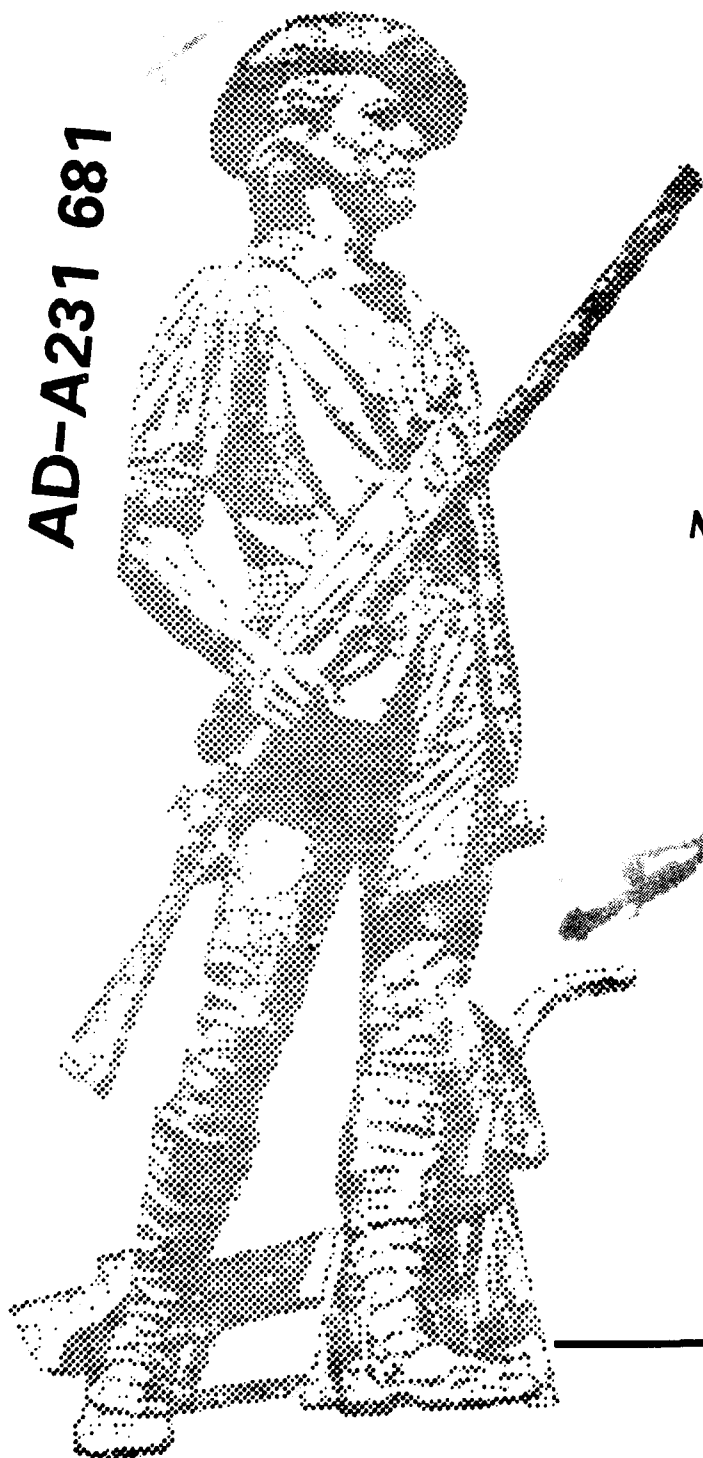


# INSTALLATION RESTORATION PROGRAM

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## Preliminary Assessment

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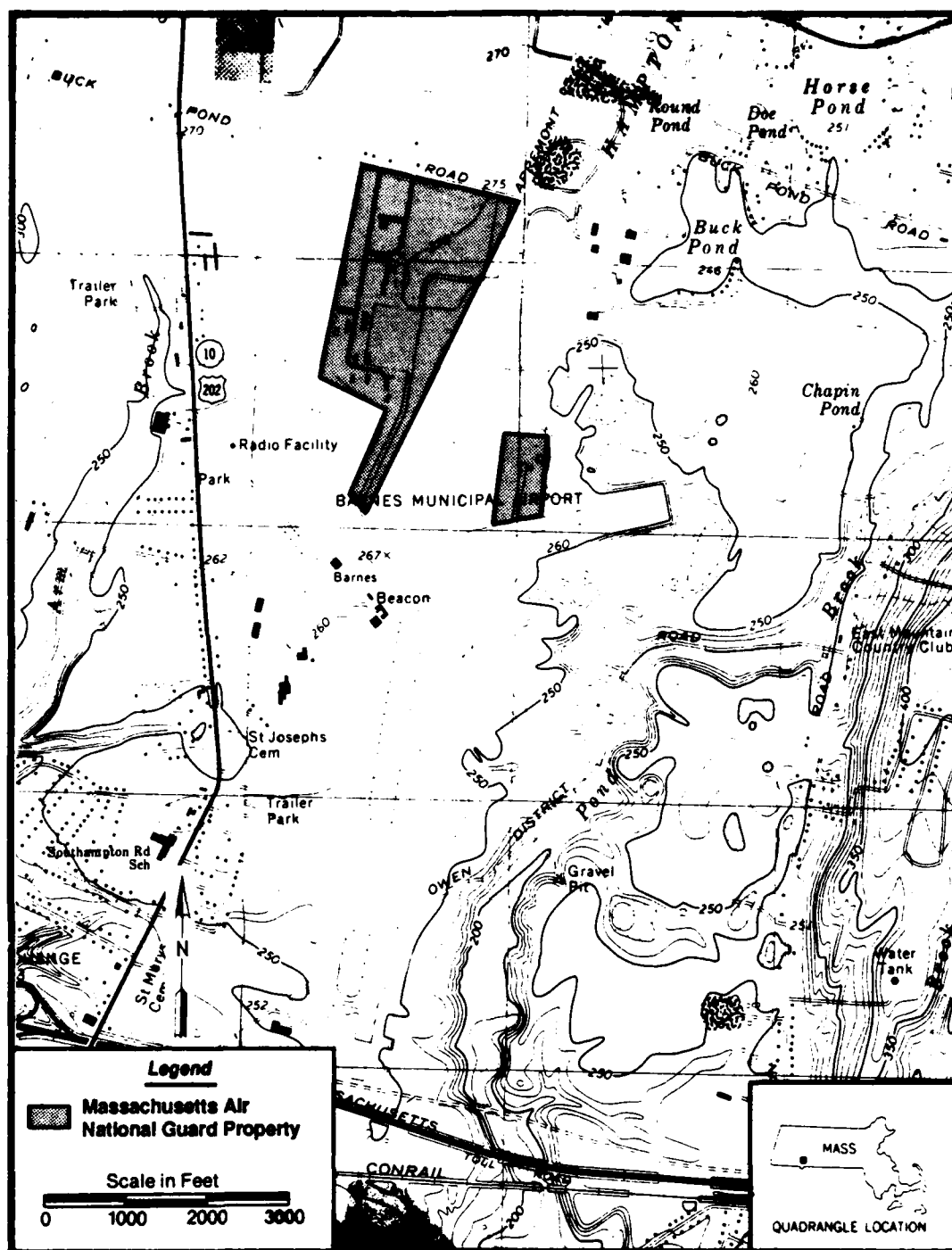
104th Tactical Fighter Group  
Massachusetts Air National Guard  
Barnes Municipal Airport  
Westfield, Massachusetts

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Hazardous Materials Technical Center  
March 1988



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INSTALLATION RESTORATION PROGRAM  
PRELIMINARY ASSESSMENT

FOR

104th TACTICAL FIGHTER GROUP  
MASSACHUSETTS AIR NATIONAL GUARD  
BARNES MUNICIPAL AIRPORT  
WESTFIELD, MASSACHUSETTS

March 1988

Prepared for

National Guard Bureau  
Andrews Air Force Base, Maryland 20331

Prepared by

The Hazardous Materials Technical Center  
The Dynamac Building  
11140 Rockville Pike  
Rockville, Maryland 20852

Contract No. DLA 900-82-C-4426

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## EXECUTIVE SUMMARY

### A. INTRODUCTION

The Hazardous Materials Technical Center (HMTc) was retained in August 1987 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 104th Tactical Fighter Group (TFG), Massachusetts Air National Guard, Barnes Municipal Airport, Westfield, Massachusetts (hereinafter referred to as the Base), under Contract No. DLA 900-82-C-4426. The Preliminary Assessment included:

- o an onsite Base visit, including interviews with 16 Base personnel conducted by HMTc personnel during 1-4 September 1987;
- o the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the Base;
- o the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- o the identification of sites on the Base that are potentially contaminated with hazardous material/hazardous waste (HM/HW).

### B. MAJOR FINDINGS

Past Base operations involved the use and disposal of material and waste that subsequently were categorized as hazardous. The major operations of the Base that have used and disposed of these materials and wastes include aircraft maintenance; aerospace ground equipment maintenance; ground vehicle maintenance; and petroleum, oil, and lubricant (POL) management and distribution. The operations involve such activities as corrosion control, nondestructive inspection, fuel cell maintenance, and engine maintenance. Waste oils, recovered fuels, spent cleaners, paint removers, thinners, strippers, and cleaning solvents were generated by these activities.

Interviews with 16 Base personnel and a field survey resulted in the identification of seven potential disposal and/or spill sites at the Base. The seven sites are potentially contaminated with HM/HW and five were assigned a Hazard Assessment Score (HAS) according to the U.S. Air Force Hazard Assessment Rating Methodology (HARM). The seven potentially contaminated sites are as follows:

Site No. 1 - Fire Training Area (HAS-64)

Since the 1950s, the Base has used this fire training area (FTA), which is located north of Runway 15 in the western portion of the airport. Since the late 1970s, this FTA has had a traprock (basalt) base which impedes surface water percolation. Substances, including JP-4, AVGAS, and Naptha, have been used in periodic fire training exercises. The FTA is used primarily by the Base, but is not located on Base property.

Site No. 2 - Tank Sludge Disposal Area (HAS-54)

During the 1950s, approximately 500 gallons of AVGAS storage tank sludge containing tetraethyllead was disposed along the north-south trending fenceline west of the fuels facility (Building 010). No visible evidence of hazardous waste disposal was present at this site, although a sign which read "Tetraethyllead buried here" had once marked the disposal site.

Site No. 3 - Motor Pool Excavation Area (HAS-54)

During the site survey, an area located just south of the motor pool (Building 006) was visibly saturated with what appeared to be waste POL product. Interviewees' suggested that it was the result of overflow from the wash rack area.

Site No. 4 - Storm Water Retention Pond (HAS-56)

A storm water retention pond, located approximately 400 feet of the Avionics Building (Building No. 026), receives storm water from the northern third of the Base. No visible evidence of hazardous waste disposal was present, although Base personnel did report that a spill of approximately 100 gallons of JP-4 had travelled to the pond from the Hangar area.

Site No. 5 - Original Aircraft Maintenance Area/Grassy (HAS-56)

In 1963, there was a reported spill of approximately 100 gallons of JP-4 jet fuel at this site. It was thought that the majority of the fuel flowed into a nearby grassy swale which eventually discharged into a wooded area south of the Officers Club (Building 050).

Site No 6 - Old Fire Training Area (Unscored)

Two areas located at the east side of the airport were used for fire training exercises in the late 1950s and early 1960s. No visible evidence of hazardous waste disposal was present, although Base personnel did report that the two areas were used for a limited time period.

Site No. 7 - Dry Well Area (Unscored)

This site is located adjacent and to the south of Building 020. According to Base personnel, two dry wells may have been used for disposal of shop wastes in the past. No evidence of waste disposal at the site was substantiated during the site survey.

C. CONCLUSIONS

Seven areas that may be contaminated with HM/HW were initially identified on the Base. Evidence from the seven sites suggests that they may be contaminated, and that the potential for contaminant migration exists. Five of these sites were assigned a HAS according to HARM:

D. RECOMMENDATIONS

Because the potential exists for groundwater and migration of contaminants from the seven identified sites at the Base, initial investigative stages of the IRP Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) are recommended. The primary purposes of the subsequent investigations are:

1. To determine whether pollutants are present at each site, or to determine that no pollutants are present;
2. To determine whether groundwater at each site has been contaminated and if it has, give quantification with respect to contaminant concentration, the boundary of the contaminant plume, and the rate of contaminant migration, and;
3. To select an appropriate remedial action alternative for mitigating environmental contamination.

## I. INTRODUCTION

### A. Background

The 104th Tactical Fighter Group (TFG) is located at the Massachusetts Air National Guard, Barnes Municipal Airport, Westfield, Massachusetts, (hereinafter referred to as the Base). The TFG was established in February, 1947. Both past and present operations have involved the use and disposal of materials and wastes that subsequently were categorized as hazardous. Consequently, the National Guard Bureau has implemented an Installation Restoration Program (IRP) which consists of the following:

Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) - to acquire data via field studies for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment, and to select a remedial action through preparation of a feasibility study.

Research, Development, and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation.

Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement remedial action.

### B. Purpose

The purpose of this IRP Preliminary Assessment is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Base. The Hazardous Materials Technical Center (HMTTC) visited the Base, reviewed existing environmental information, analyzed the Base records concerning the use and generation of hazardous material/hazardous waste (HM/HW), conducted interviews with past and present personnel of the Base who are familiar with past HM/HW management activities, and made a physical inspection of the suspected sites. Relevant information col-

lected and analyzed included the Base history, with special emphasis on the history of the shop operations and their past HM/HW management procedures; local geological, hydrological, and meteorological conditions that could affect migration of contaminants; local land use, public utilities, and zoning requirements that affect the potential for exposure to contaminants; and the ecological settings that indicate environmentally sensitive habitats or evidence of environmental stress.

#### C. Scope

The scope of this Preliminary Assessment is limited to the Base and includes

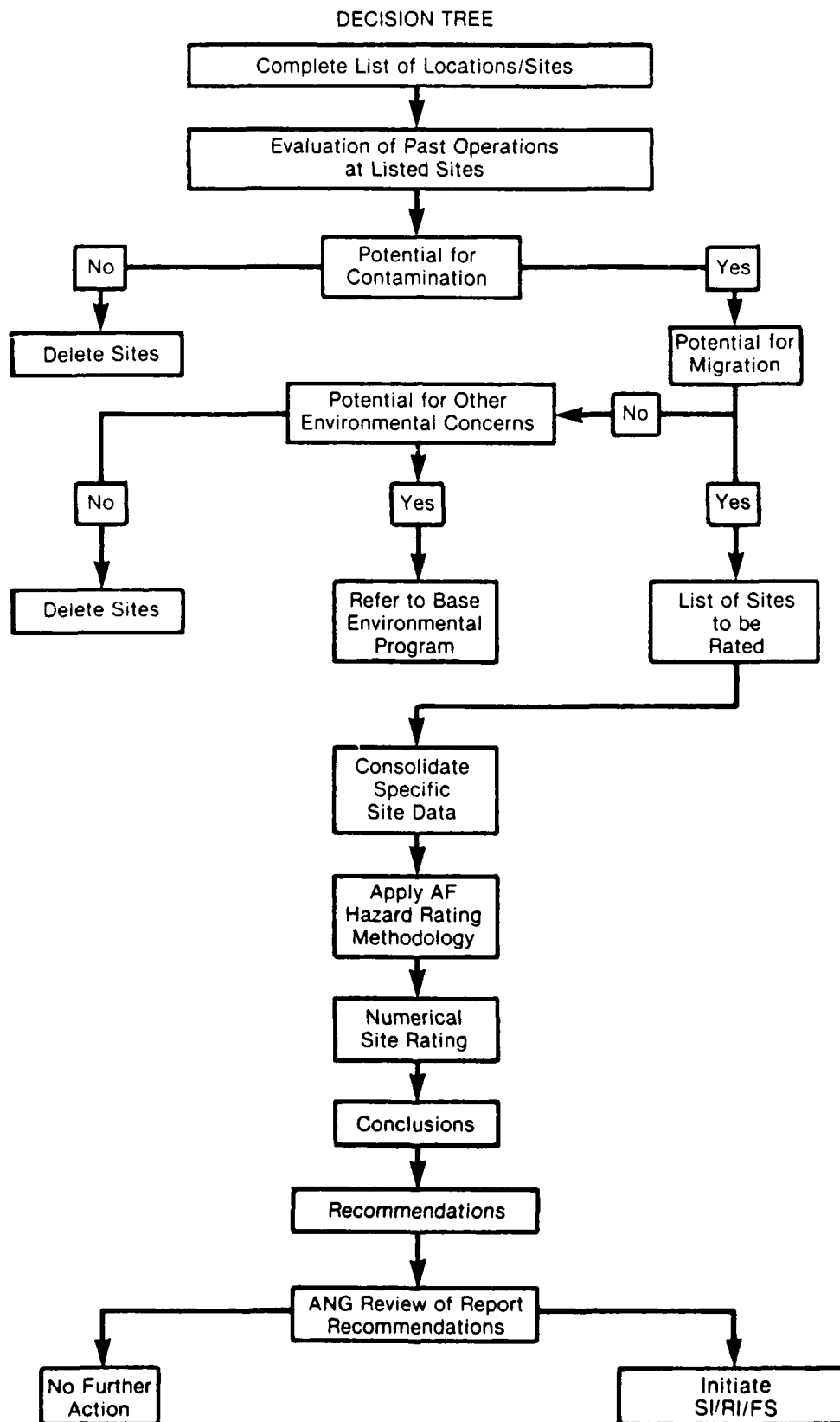
- o An onsite visit;
- o The acquisition of pertinent information and records on hazardous material use and hazardous waste generation and disposal practices at the Base;
- o The acquisition of available geologic, hydrologic, meteorologic, land-use and zoning, critical habitat, and utility data from various Federal, Commonwealth of Massachusetts, and local agencies;
- o A review and analysis of all information obtained; and
- o The preparation of a report to include recommendations for further actions.

The onsite visit, and interviews with past and present personnel were conducted during the period 1-4 September 1987. The HMTC Preliminary Assessment effort was conducted by Mr. Mark Johnson, Geologist; Mr. Jeffrey D. Fletcher, Staff Scientist/Geologist; and Ms. Kathryn Gladden, Chemical Engineer. (Resumes are included as Appendix A). Individuals who assisted in the Preliminary Assessment include selected members of the 104th TFG. The Base Point of Contact (POC) was Lieutenant Colonel Walter W. Forbush, Base Civil Engineer.

#### D. Methodology

A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This Preliminary Assessment Methodology ensures a comprehensive collec-

Preliminary Assessment Methodology Flow Chart.



tion and review of pertinent site-specific information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Preliminary Assessment began with a site visit to the Base to identify all shop operations or activities on the Base that may have used hazardous material or generated hazardous waste. Next, an evaluation of past and present HM/HW handling procedures at the identified locations was made to determine whether environmental contamination may have occurred. The evaluation of past HM/HW handling practices was facilitated by extensive interviews with 16 past and present employees familiar with the various operating procedures at the Base. These interviews also defined the areas on the Base where waste materials, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or released into the environment.

Appendix B lists the interviewees' principal areas of knowledge and their years of experience with the Base. Historical records contained in the Base files were collected and reviewed to supplement the information obtained from interviews. Using the information outlined above, a list of past waste spill/disposal sites on the Base were identified for further evaluation. A general survey tour of the identified spill/disposal sites, the Base, and the surrounding area was conducted to determine the presence of visible contamination and to help the HMTTC survey team assess the potential for contaminant migration. Particular attention was given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geological, hydrological, meteorological, development (land use and zoning), and environmental data for the area of study was also obtained from the POC, or from appropriate Federal, State, and local agencies. A list of outside agencies contacted is in Appendix C. Following a detailed analysis of all the information obtained, four areas were identified as suspect areas where HM/HW disposal may have occurred. Evidence at the four sites suggests that they may be contaminated and that the potential for contaminant migration exists. Two of these sites were assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology (HARM).

## II. INSTALLATION DESCRIPTION

### A. Location

The 104th TFG is located at the Barnes Municipal Airport. The airport is located on U.S. Route 202 and Interstate 90, within the corporate boundaries of Westfield, Massachusetts. The 104th occupies the northwest corner of the airport just south of Buck Pond Road. Figure 2 displays the area studied for this Preliminary Assessment.

In the area immediately north, west, and south of the airport is industrial property, cropland and low density residential structures. East of the airport, land use is largely cropland or forest (see Figure 2).

### B. History

In early 1947, the Barnes Municipal Airport leased a parcel of land, in the unused northwest corner of the airport, to the newly founded Massachusetts ANG. In April 1947, the Base was activated as the 104th TFG with its first fighter plane, a P-47 Republic Thunderbolt.

By 1951, the 104th had grown in stature, prominence, and size, with the replacement of the P-47 Thunderbolts with the P-51 Mustangs. The P-51 Mustangs were then replaced by the F-94 Starfire. The year 1957 saw the arrival of the F-84H Sabrejets which had been the top fighter of the Korean War. These remained in the 104th inventory until they were replaced by the F-84F Thunderstreak in 1965. The F-84 was on board until the arrival of the F-100 Supersabres in 1971. The aging Supersabres were replaced in 1979 by the A-10 Thunderbolt II, thus completing the cycle from Thunderbolt I (P-47) to Thunderbolt II (A-10).

Adapted From:  
USGS 7-½ minute Quadrangle  
Mount Tom - Massachusetts  
(1972)

### III. ENVIRONMENTAL SETTING

#### A. Meteorology

The meteorological information presented below is from local climatological data for the Westfield, Massachusetts area compiled by the National Oceanic and Atmospheric Administration (NOAA). The proximity to the Atlantic Ocean and the Berkshire Hills plays an important part in determining the weather and climate of this part of Massachusetts. Rapid weather changes occur when storms move up the east coast after developing off the Carolina Coast. In the majority of these cases, they pass to the south and east, resulting in northwest and easterly winds with rain or snow and fog. Storms developing in the Texas-Oklahoma area normally travel up the St. Lawrence River Valley and, depending on the movement and intensity, usually deposit little precipitation over the area. However, they do bring an influx of warm air into the region. Wintertime cold snaps are quite frequent, but temperatures are usually modified by the passage of the air over the Berkshires. Meteorological records compiled since 1901 show maximum temperatures above 100 degrees and minimum temperatures below -24 degrees.

Precipitation is usually well distributed throughout the year. The average annual snowfall for the Westfield area is approximately 60 inches.

Westfield, Massachusetts and vicinity, has an average annual precipitation of approximately 48.00 inches based on the period from 1957-1986. By calculating net precipitation according to the method outlined in the Federal Register (47 FR 31224, 16 July 1982), a net precipitation value of 21.00 inches per year is obtained. Rainfall intensity based on 1-year, 24-hour duration rainfall is 2.50 inches (calculated according to 47 FR 31235, 16 July 1982, Figure 8).

#### B. Geology

The geological and hydrological information presented below was gathered through various sources from the U.S. Geological Survey, Reston, Virginia and also from hydrological reports from the Westfield Water Department, Westfield, Massachusetts.

The Base is located in the Connecticut Valley Physiographical region of south-central Massachusetts. This region is further divided into areas called Mesozoic Basins. The Barnes Municipal Airport, including the Base, is located within the Hartford Basin, which stretches from Hartford, Connecticut north into central Massachusetts. The Basin is characterized by Jurassic Period (190 million years old) bedrock underlayed by older Triassic Period (220 million years old) bedrock. The bedrock includes primarily sedimentary and igneous rock types with local areas of metamorphism. Rocks indigenous to this area include sandstone, siltstone, shale, and basalt (Goldsmith, 1983).

The general topography of the Westfield area is characterized by a narrow valley bounded by East Mountain to the east and the leading edge of the Berkshires to the west. The Base topography is relatively flat, with elevations of 260 feet at the approach end of Runway 27, to 270 feet in the vicinity of the Base Hangar.

The major bedrock formations in the area encompassing the Base are the Hitchcock Volcanics and the New Haven Arkose. The Hitchcock Volcanics was deposited approximately 200 million years ago during the Jurassic Period. This formation is characterized by nested cones of basaltic breccia containing abundant fragments of New Haven Arkose. The New Haven Arkose was deposited approximately 210 million years ago during the Jurassic and Triassic Period and is characterized by red, pink, and gray coarse-grained, locally conglomeratic arkose interbedded with brick-red shaley siltstone and fine-grained arkosic sandstone.

At the Base, the New Haven Arkose is overlain by glacial material deposited less than 2 million years ago during the Quaternary Period. These surficial deposits primarily consist of glacial outwash material composed of unconsolidated sand and gravel to depths of 100 to 150 feet below the surface (Goldsmith, 1983).

### C. Soils

According to the U.S. Soil Conservation Service, the name of the primary soil type at the Base is Windsor Sand. The soil type consists of 6 to 10 inches of light-yellow or brown coarse sand resting on a yellowish coarse sand and fine, slightly loamy gravel. This material grades at a depth of 16 inches into a very loose gray coarse sand and gravel which extends to depths of 40 feet or more. The origin of the Windsor sand is thought to be the result of an ancient shallow lake that once occupied the area (Fippin, 1903).

### D. Hydrology

#### Surface Water

The Base is located within one major drainage basin and two drainage sub-basins. The Connecticut Lowland drainage basin is located primarily to the east of the Base and eventually drains into the Connecticut River. The Westfield River drainage sub-basin includes most of the Westfield area and drains into the Westfield River, located to the south of the Base. The Manhan River drainage sub-basin includes areas to the west of the Base and drains into the Manhan River, located approximately 2 miles north-west of the Base (Delaney and Maevsky, 1980).

Storm water from the northern one-third of the Base discharges into storm drains which ultimately flow into a storm-water retention pond located in the northwest corner of the Base. Storm water from the southern two-thirds of the Base drain through storm drains and swales in a southwesterly direction and ultimately discharge into a wooded area, where it dissipates into the underlying groundwater system. The U.S. Geological Survey, seven and one-half quadrangle, map of the area indicates that there are no surface streams discharging from either the wooded areas or the retention pond. The general surface water flow direction in the Westfield area is to the south-southwest (U.S.G.S., 1972).

According to an aquifer and municipal water supply distribution map of the Westfield, Massachusetts area, the Barnes Municipal Airport, including the Base, is in an area of minimal flooding from rivers.

#### Groundwater

Municipal supplies derived primarily from wells screened in the surficial deposits are the primary water source for the City of Westfield, including the Barnes Municipal Airport.

The surficial deposits are glacial in origin and are characterized by unconsolidated sand and gravel. These deposits are known or inferred to have more than 10 feet of water-saturated thickness and/or capable of yielding more than 30 gallons per minute to individual wells. Of nine municipal wells, two wells (Nos. 7 and 8) are located approximately 1,000 feet to the east of the approach end of Runway 27. Water from these wells is being derived from 5 to 17 feet in depth at an average of 710 gallons per minute.

Estimated mean depths to the water table for the Connecticut Lowland drainage basin and Westfield River drainage sub-basin, are 20 and 15 feet, respectively.

A report on local reservoirs and wells, stated that of 31,433 people living within the Westfield corporate boundary, 85 percent were receiving public water supplies (Walker and Caswell, 1977).

#### E. Critical Habitats/Endangered or Threatened Species

Discussions with personnel from the Massachusetts Division of Fisheries and Wildlife disclosed that there was a sighting of a State Threatened Species of fauna in the vicinity of the Barnes Municipal Airport; namely, the Marbled Salamander (*Ambystoma opacum*). Although, the area within a one-mile radius of the airport is not considered a major habitat of any endangered or threatened species. There are minor wetlands located approximately 1 mile east and north-east of the Base, adjacent to Pond Brook and Hampton Ponds. Also, Hampton Ponds State Park, a wilderness area, is located approximately 1 mile north-east

of the Base.

#### IV. SITE EVALUATION

##### A. Activity Review

A review of Base records and interviews with past and present personnel at the Base resulted in the identification of specific operations within each activity in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 1 summarizes the major operations associated with each activity, provides estimates of the quantities of waste currently being generated by these operations, and describes the past and present disposal practices for the wastes. Based on information gathered, any operation that is not listed in Table 1 has been determined to produce negligible (less than 5 gallons/year) quantities of wastes requiring disposal.

##### B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

Interviews with 16 Base personnel (Appendix B) and subsequent site inspections resulted in the identification of seven waste disposal/spill sites. It was determined that the seven sites are potentially contaminated with HM/HW, and have a potential for migration; therefore, they should be further evaluated. Five of the seven sites were scored using HARM (Appendix D). Figure 3 illustrates the locations of the sites. A copy of the completed Hazardous Assessment Rating Form is found in Appendix E. Table 2 summarizes the Hazard Assessment Score (HAS) of the scored sites.

###### Site No. 1 - Fire Training Area (HAS-64)

The Fire Training Area (FTA) is located north of Runway 15, just outside the Base (see Figure 3). Although this site is not within the Base property, it is being addressed in the Preliminary Assessment because the ANG has been the primary user of this site, and as such holds ultimate responsibility for any waste found there.

Table 1. Hazardous Materials/Hazardous Waste Disposal Summary: Massachusetts Air National Guard, Barnes Municipal Airport, Westfield, Massachusetts

SHOP NAME	BUILDING NO.	WASTE MATERIAL	WASTE QUANTITY (GALLONS/YEAR)	1945	1955	1965	1975	1985	Present
Aircraft Maintenance	020	Engine Oil	300		FTA/CONTR		CONTR		DRMO
Aerospace Ground Equipment		Aircraft Cleaning Compound	200				CONTR		DRMO
		Hydraulic Oil	100				CONTR		DRMO
		PD-680	100		FTA/CONTR		CONTR		DRMO
		Carbon Removal Compound	50						DRMO
		7808 Oil	25		FTA/CONTR		CONTR		DRMO
		Battery Acid	10		SEPT		NEUTR SEPT		DRMO
Vehicle Maintenance	006	Engine Oil	440		FTA/CONTR		CONTR		DRMO
		Hydraulic Oil	165		F A/CONTR		CONTR		DRMO
		Ethylene Glycol	110		STORM		CONTR		DRMO
		Paint Thinner	55		FTA/STORM/CONTR		CONTR		DRMO
		Lacquer	5		STORM		CONTR		DRMO
Non-Destructive Inspection	020	Trichloroethane	20						DRMO
		Penetrant	20						DRYWELL
		Emulsifier	20						DRYWELL
		Developer	10						DRYWELL
		Fixer	10						DRYWELL
Fuels Management	010	JP-4	350				FTA		
Paint Shop	027	Paint Thinners	50		FTA/STORM/CONTR		CONTR		DRMO
		Paint Stripper Residue	5		LNDFL		CONTR		DRMO
		Paint Containers	50				LNDFL		

CONTR - Disposed of through Hazardous Waste Contractor.  
 DRMO - Disposed of through the Defense Reutilization and Marketing Office.  
 FTA - Burned at Fire Training Area.  
 NEUTR SEPT - Neutralized and disposed of through septic system.  
 SEPT - Disposed of in drains leading to septic system.  
 STORM - Disposed of in drains leading to storm sewer.  
 LNDFL - Landfilled offsite.  
 DRYWELL - Disposed of in dry wells.

HMTC

Adapted From:  
Barnes Municipal Airport  
Plan (November, 1981)

**Figure 3.**  
Location of Sites at Massachusetts ANG, Barnes  
Municipal Airport, Westfield, Massachusetts.

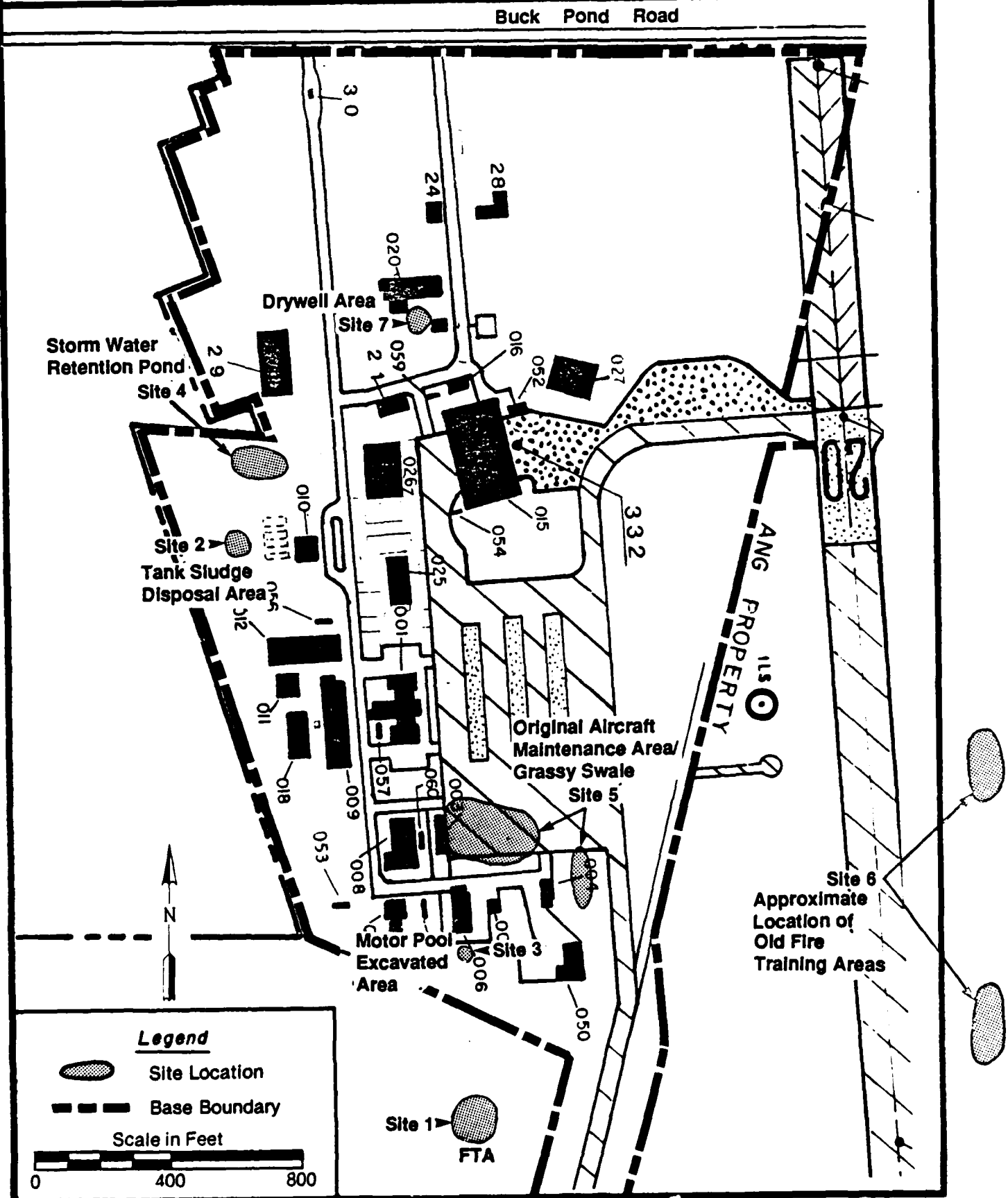


Table 2. Site Hazard Assessment Scores (as Derived from HARM):  
Massachusetts Air National Guard, Barnes Municipal  
Airport, Westfield, Massachusetts

Site Priority	Site No.	Site Description	Receptors	Waste Characteristics	Pathway	Waste Mgmt. Practices	Overall Score
1	1	Fire Training Area	63	80	48	1.0	64
2	4	Storm Water Retention Pond	63	50	56	1.0	56
3	5	Original Air- craft Mainte- nance Area/ Grassy Swale	63	50	56	1.0	56
4	2	Tank Sludge Disposal Area	63	50	48	1.0	54
5	3	Motor Pool Excavation Area	63	50	48	1.0	54

The FTA consists of an open circular area containing the remnants of a F-100 fighter jet. Use of the FTA began about 1950 on unprepared ground. The procedure was to soak the ground with water from a water tanker, release flammable liquids onto the area and then ignite. Fire training exercises had been held at this location on the average of every 6 weeks during the summer months, since the 1950s. Since 1979, JP-4 jet fuel was the only fuel used in the training exercises. Although, prior to 1979 flammable substances, including AVGAS, naptha, and reciprocating engine oils, were also ignited in the FTA. It was reported that on the average, 300 to 500 gallons of flammable liquids had been disposed in the FTA during each exercise, with approximately 75-85% of the liquid being burned off.

Containment structures are minimal at the FTA. A 12-inch, relatively impermeable traprock (basalt) base was installed in 1979. Prior to this time, the area was unlined. As of August 1987, fire training exercises had been discontinued and no signs of floating hydrocarbons or odor of POL product were detected.

Regular use of the FTA as a disposal site for hazardous wastes creates a potential for ground and surface water contamination and, therefore, a HAS was applied. Additionally, from experience, old unlined FTAs lacking proper containment structures often present troublesome sites of contamination on ANG and Air Force bases. Therefore, a higher priority for additional investigation is warranted at this site.

This site and two other previously used FTAs were brought to the attention of the ANG Bureau in a letter written by the Base (19 August 1987), which summarized the history of the FTAs and their potential need for further investigation.

#### Site No. 2 - Tank Sludge Disposal Area (HAS-54)

This site is located west of the fuels facility (Building 010), along the north-south trending fenceline (see Figure 3). At the time of the site survey, there was no visible evidence of contamination at this site. Interviews with Base personnel suggests that tank sludges from underground fuel tanks con-

taining AVGAS were disposed of and buried in this area during the 1950s. Approximately 150 gallons of sludge, containing tetraethyllead was disposed of following routine tank cleanings. This procedure occurred at least three times during the 1950s, resulting in the disposal of approximately 500 gallons of sludge at the site.

Base personnel stated that a sign posted near the site read, "Tetraethyllead buried here," although no sign was located at the time of the site survey. Even though visible contamination was not observed, the site was scored as a "small" quantity release (less than 20 drums or 1,000 gallons) because of the past disposal of tank sludges containing tetraethyllead.

#### Site No. 3 - Motor Pool Excavation Area (HAS-54)

This site is located approximately two feet south of the fenceline which surrounds the motor pool wash rack (see Figure 3). The site is a rectangular area, approximately 5 feet by 10 feet, which has been excavated to a depth of about 5 inches. At the time of the site survey, the area was visibly saturated with what appeared to be waste POL product. Interviews with Base personnel and a site survey, determined that the saturated soil was probably the result of overflow from the wash rack area and that the contaminated earth was apparently disposed of in the Fire Training Area. Based on the information available through the Preliminary Assessment process, this site was scored as a small quantity release (less than 20 drums or 1,000 gallons) and additional IRP investigations are warranted at this site.

#### Site No. 4 - Storm Water Retention Pond (HAS-56)

This site is located approximately 400 feet west of the Avionics building, Building No. 026 (see Figure 3). Storm water from approximately the northern third of the Base drain into this area.

According to interviews with Base personnel, the Retention Pond receives effluent from the Hangar and the Maintenance Building (Building No. 020) areas (see Figure 3). During the site survey, there were no observed signs of contamination (i.e., vegetation stress, odor). However, in 1961, there was a con-

firmed spill of at least 100 gallons of JP-4 jet fuel, which eventually travelled to this pond. Based on the information available through the Preliminary Assessment, this area was scored as a small quantity release and a HAS was applied. Additional IRP investigations at this site are warranted and should be undertaken.

Site No. 5 - Original Aircraft Maintenance Area/Grassy Swale (HAS-56)

This site is located adjacent and east of Building 003 (see Figure 3). During the 1950s and early 1960s, the site was used as a Base aircraft maintenance area.

According to Base personnel, in 1963 there was a reported release of approximately 100 gallons of JP-4 jet fuel at this site. At the time of the release, it was thought that the majority of jet fuel flowed into a nearby grassy swale, which is located east of the current Base fire department (Building 004), before it dissipated into the ground. During the site survey, there was no observed signs of contamination. Based on the information obtained through the Preliminary Assessment, the site was scored as a small quantity release and a HAS was applied.

Site No. 6 - Old Fire Training Areas (Unscored)

Two previous areas used for fire training exercises were also mentioned by Base personnel.

One of these areas is located along a dirt road in the northeast section of the airport (see Figure 3). During the 1950s, this FTA was used at the request of the airport management, because of an incident involving a startled passenger during passenger emplanement. After 2 to 3 years of operation in this area, the FTA was relocated back to its original site (Site No. 1 - FTA) with the concurrence of the airport manager.

The second area used for fire training exercises was located at the approach end of Runway 27 (see Figure 3). This area was used during one summer in late 1950s to determine the response time of the 0-10 fire trucks. Follow-

ing the one-time use, the FTA was again relocated back to the previously used FTA (Site No. 1). Based on the limited time periods the 2 FTAs were used, and the information obtained through the Preliminary Assessment, a HAS was not determined. However, additional IRP investigations are warranted and should be undertaken.

Site No. 7 - Dry Well Area (Unscored)

This site is located adjacent and south of Building 020 (see Figure 3). According to Base personnel, two dry wells were located at this site; although there was no confirmed evidence of hazardous waste disposal or spills at the site. However, based on previous information, dry wells have been used for disposal of shop wastes at other installations and it was reported that wastes may have been disposed of at this site on occasion. Based on the information available through the Preliminary Assessment, a HAS cannot be determined. However, additional IRP investigations at this site are warranted and should be undertaken.

D. Other Pertinent Facts

- o Storm water from the southern half of the Base drains to a storm water retention pond, located in a wooded area southwest of the Base. The storm water eventually dissipates into the ground.
- o Base refuse has always been shipped offbase.
- o A sanitary sewage system for the northern half of the Base was installed in 1982/1983. The southern half of the Base was, and still is, equipped with a septic system.
- o There has not been extensive use or storage of pesticides or fertilizers on the Base.
- o No radioactive wastes have been disposed of on the Base.
- o There are no inactive landfills on the Base.

## V. CONCLUSIONS

Information obtained through interviews with 16 Base personnel, review of Base records, and field observations have resulted in the identification of seven potentially contaminated disposal and/or spill sites on Base property. These sites consist of the following:

- o Site No. 1 - Fire Training Area (HAS-64)
- o Site No. 2 - Tank Sludge Disposal Area (HAS-54)
- o Site No. 3 - Motor Pool Excavation Area (HAS-54)
- o Site No. 4 - Storm Water Retention Pond (HAS-56)
- o Site No. 5 - Original Aircraft Maintenance Area/Grassy Swale (HAS-56)
- o Site No. 6 - Old Fire Training Areas (Unscored)
- o Site No. 7 - Dry Well Area (Unscored)

The seven potentially contaminated sites exhibit the potential for contaminant migration to groundwater and surface water. Five of these sites have been further evaluated using HARM and warrant further IRP investigation. Site No. 6 (Old Fire Training Area) was unscored under HARM because of the short period of time the areas were used. Also, through visual inspection and Base personnel interviews, it was thought that minimal amounts of wastes were disposed of at these sites. Site No. 7 (Dry Well Area) was also unscored under HARM because there was no confirmed reports of HM/HW disposal at the site.

## VI. RECOMMENDATIONS

Because of the potential for contaminant migration, initial investigative stages of the IRP SI/RI/FS are recommended for all of the scored and unscored sites identified at the Base. The following recommendations are made to ascertain if groundwater at the seven identified sites has been contaminated, and to confirm or refute that Base-generated contaminants are migrating off the Base.

### Site No. 1 - Fire Training Area

Soil contamination at this site has been confirmed. Subsequent IRP analysis should be performed to determine the extent of soil contamination and to determine if groundwater contamination exists.

### Site No. 2 - Tank Sludge Disposal Area

Further IRP analysis at this site is required to determine if contamination exists.

### Site No. 3 - Motor Pool Excavation Area

Further IRP analysis at this site is required to determine if contamination exists.

### Site No. 4 - Storm Water Retention Pond

Further IRP analysis at this site is required to determine if contamination exists.

### Site No. 5 - Original Aircraft Maintenance Area/Grassy Swale

Further IRP analysis at this site is required to determine if contamination exists.

Site No. 6 - Old Fire Training Area

Further IRP analysis at this site is required to determine if contamination exists.

Site No. 7 - Dry Well Area

Further IRP analysis at this site is required to determine if contamination exists.

## GLOSSARY OF TERMS

**AQUIFER** - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

**ARKOSE** - A feldspar-rich sandstone, typically coarse-grained and pink or reddish, that is composed of angular to subangular grains that may be either poorly or moderately well sorted, is usually derived from the rapid disintegration of granitic rocks.

**BASALT** - A general term for dark-colored mafic igneous rocks, commonly extrusive but locally intrusive (e.g. as dikes), composed chiefly of calcic plagioclase and clinopyroxene.

**CONTAMINANT** - As defined by Section 101(f)(33) of SARA shall include, but not be limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

- (a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,
- (b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,
- (c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),
- (d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

- (e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and
- (f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquified natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

**CRITICAL HABITAT** - The native environment of an animal or plant which, due either to the uniqueness of the organism or the sensitivity of the environment, is susceptible to adverse reactions to environmental changes such as may be induced by chemical contaminants.

**DOWNGRADIENT** - A direction that is hydraulically downslope; the direction in which groundwater flows.

**ENDANGERED SPECIES** - Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

**GROUNDWATER** - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

**HARM** - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981).

**HAS** - Hazard Assessment Score - The score developed by utilizing the Hazardous Assessment Rating Methodology (HARM).

**HAZARDOUS MATERIAL** - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

- a. Cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness; or
- b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

JURASSIC - The second period of the Mesozoic era (after the Triassic and before the Cretaceous), thought to have covered the span of time between 190 and 135 million years ago; also, the corresponding system of rocks.

METAMORPHISM - The mineralogical, chemical, and structural adjustment of solid rocks to physical and chemical conditions which have generally been imposed at depths below the surface zones of weathering and cementation, and which differ from the conditions under which the rocks in question originated.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil and air).

OUTWASH - Stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

QUATERNARY - The second period of the Cenozoic era, following the Tertiary, also, the corresponding system of rocks. It began two to three million years ago and extends to the present.

SANDSTONE - A medium-grained clastic sedimentary rock composed of abundant rounded or angular fragments of sand size set in a fine-grained matrix (silt or

clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate); the consolidated equivalent of sand, intermediate in texture between conglomerate and shale.

SILTSTONE - An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which the silt predominates over clay; a nonfissile silt shale.

SHALE - A fine-grained detrital sedimentary rock, formed by consolidation (esp. by compression) of clay, silt, or mud.

SOIL PERMEABILITY - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as to the number of inches per hour that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	- less than 0.06 inches per hour (less than $4.2 \times 10^{-5}$ cm/sec)
Slow	- 0.06 to 0.20 inches per hour ( $4.2 \times 10^{-5}$ to $1.4 \times 10^{-4}$ cm/sec)
Moderately Slow	- 0.2 to 0.6 inches per hour ( $1.4 \times 10^{-4}$ cm/sec)
Moderate	- 0.6 to 2.0 inches per hour ( $4.2 \times 10^{-4}$ to $1.4 \times 10^{-3}$ cm/sec)
Moderately Rapid	- 2.0 to 6.0 inches per hour ( $1.4 \times 10^{-3}$ to $4.2 \times 10^{-3}$ cm/sec)
Rapid	- 6.0 to 20 inches per hour ( $4.2 \times 10^{-3}$ to $1.4 \times 10^{-2}$ cm/sec)
Very Rapid	- more than 20 inches per hour (more than $1.4 \times 10^{-2}$ cm/sec)

(Reference: U.S.D.A. Soil Survey)

STRUCTURAL BASIN - A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated, e.g., a circular centrocline such as the Michigan Basin, a fault-bordered intermontane feature such as the Bighorn Basin of Wyoming, or a linear crustal downwarp such as the Appalachian Basin. Such fea-

tures were basins at the time of sedimentation but are not necessarily so today.

**SURFACE WATER** - All water exposed at the ground surfaces including streams, rivers, ponds, and lakes.

**THREATENED SPECIES** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**TOPOGRAPHY** - The general conformation of a land surface, including its relief and the position of its natural and manmade features.

**TRAP ROCK** - Any dark-colored fine-grained nongranitic hypabyssal or extrusive rock, such as basalt, peridotite, diabase, or fine-grained gabbro; also applied to any such rock as crushed stone.

**TRIASSIC** - The first period of the Mesozoic era (after the Permian of the Paleozoic era, and before the Jurassic), thought to have covered the span of time between 225 and 190 million years ago, also the corresponding system of rocks.

**UPGRADIENT** - A direction that is hydraulically upslope.

**VOLCANICS** - Those igneous rocks that have reached or nearly reached the Earth's surface before solidifying.

**WATER TABLE** - As used in this report, the water table is the surface below which all the openings or voids in the ground are filled with water. It is the surface at which water stands in shallow wells, or would stand if a well were drilled.

**WETLANDS** - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes,

bogs, and similar areas.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

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2. Delaney, David F. and Maevisky, Anthony. Distribution of Aquifers - Liquid Waste Impoundments and Municipal Water Supply Sources, Massachusetts, 1972.
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8. United States Geological Survey, Bedrock Geologic Map of Massachusetts, Richard Goldsmith, et. al., 1983.
9. United States Geological Survey, Contour Map of the Bedrock Surface, Mount Tom Quadrangle, Massachusetts, 1972.
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11. United States Soil Conservation Service, Soil Survey of the Connecticut Valley, 1903.
12. Walker, Eugene H. and Caswell, William W.. Map Showing Availability of Groundwater in the Connecticut River Lowlands, Massachusetts, 1977.

**Appendix A**  
**Resumes of Preliminary Assessment**  
**Team Members**

## RAYMOND G. CLARK, JR.

### EDUCATION

Completed graduate engineering courses, George Washington University, 1957  
B.S., mechanical engineering, University of Maryland, 1949

### SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969  
Grad. Army Psychological Warfare School, Fort Bragg, 1963  
Grad. Sanz School of Languages, D.C., 1963  
Grad. DOD Military Assistance Institute, Arlington, 1963  
Grad. Defense Procurement Management Course, Fort Lee, 1960  
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

### CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303);  
Florida (#36228)

### EXPERIENCE

Twenty-nine years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

### EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager

Responsible for activities relating to Phases I, II and IV of the U.S. Air Force Installation Restoration Program including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; and preparation of Air Force Installation Restoration Program Management Guidance.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of \$163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of \$15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost \$250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than \$256 million. Planned and developed the first five-year master plan for this area. Administered \$12 million budget and \$2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth \$9 million for essential maintenance and repair. Directed cost reduction programs that produced more than \$500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than \$75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than \$200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over \$21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately \$159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

**PROFESSIONAL AFFILIATIONS**

Member, National Society of Professional Engineers  
Fellow, Society of American Military Engineers  
Member, American Society of Civil Engineers  
Member, Virginia Engineering Society  
Member, Project Management Institute

R.G. CLARK  
Page 5

HARDWARE

IBM PC

SOFTWARE

Lotus 1-2-3, D Base III Plus, Framework, Project Scheduler 5000, Harvard  
Project Manager, Volkswriter, Microsoft Project

## MARK D. JOHNSON

### EDUCATION

B.S., geology, James Madison University, 1980

### EXPERIENCE

Seven years' technical experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance and preparation of statements of work for the Air Force and the Air National Guard.

### EMPLOYMENT

Dynamac Corporation (1984-present): Staff Scientist/Geologist

Primarily responsible for preparing statements of work for Phase IV-A of the Air Force's Installation Restoration Program, statements of work for Phase II and Phase IV-A of the Air National Guard's Installation Restoration Program, and assessing groundwater of hazardous waste disposal/spill sites on military installations for the purpose of determining rates and extents of contaminant migration and for developing site investigations, remedial investigations and identifying remedial actions. Prepared management guidance document for the Air Force's Installation Restoration Program.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

### PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists  
National Water Well Association/Association of Ground Water Scientists  
and Engineers  
British Tunneling Society

## JEFFREY D. FLETCHER

### EDUCATION

B.S., geology, Millersville University, 1984

### EXPERIENCE

Technical and field experience includes geologic mapping, water well site location, and construction of water table maps. Expertise in hazardous waste management including site evaluations and preparation of records searches for the Phase I portion of the Installation Restoration Program for the Air Force and the Phase II Preliminary Assessment of the Hazardous Waste Site Investigation Program for the Federal Bureau of Prisons. Experience also includes principal investigator in charge of a Hazardous Waste Survey/Historical Records Search for the U.S. Coast Guard.

### EMPLOYMENT

Dynamac Corporation (1986-present): Staff Scientist/Geologist

Responsibilities include site evaluations and preparation of records searches for Phase I of the Installation Restoration Program for the Air National Guard and Phase II - Preliminary Assessments of the Hazardous Waste Site Investigation Program for the Federal Bureau of Prisons. Efforts include assessment of hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for identifying remedial actions.

Fletcher-Lowright and Assoc., Consulting Geologists (1984-1985): Geohydrology Assistant

Primary duties included site location of water wells, analysis of well yield data through the use of computers, and construction of water table maps.

KATHRYN A. GLADDEN

EDUCATION

B.S., chemical engineering (minor in biological sciences), University of Washington, 1978

SECURITY CLEARANCE

Secret DOD clearance

EXPERIENCE

Seven years of experience in hazardous waste consulting and plant process engineering. Experience includes development of engineering alternatives for reduction of in-plant effluents and preparation of RCRA background listing documents for the plastics industry.

EMPLOYMENT

Dynamac Corporation (1985-present): Staff Engineer

Performs studies on the feasibility of solvent recycling, including the evaluation of several alternatives. Studies to date have included 15 sites. For each site, prepared reports describing present practice for solvent use and disposal, and conducted economic analyses of options.

Conducted preliminary site investigations and ranking of hazardous waste sites for the U.S. Federal Bureau of Prisons. Prepared reports detailing site investigation findings and recommendations for Phase II monitoring and sampling.

Preparing statement of work for a Phase IV-A remedial action plan for the Air Force's Installation Restoration Program.

Conducted analysis of public comments on Advanced Notice of Public Rulemaking to establish National Primary Drinking Water Regulations for radionuclide contaminants.

Peer Consultants (1984-1985): Staff Engineer

Developed background documents for listing of RCRA hazardous wastes.

Engineering Science (1983-1984): Staff Engineer

Conducted regulatory policy review and technology assessment of transportation and decontamination procedures for acutely hazardous wastes. Project engineer for development of a cost analysis methodology for the U.S. Army Toxic and Hazardous Materials Agency Installation Restoration Program.

Weyerhaeuser Company (1978-1983): Chemical Engineer

Conducted plant environmental audits to develop in-plant effluent load balances; developed capital alternatives and improved operating procedures for in-plant effluent reduction; developed and implemented recommendations for plant energy conservation and process optimization programs; investigated industrial hygiene impacts of wood pyrolysis air emissions, and performed pilot trials for wood gasification and pyrolysis technology development.

PROFESSIONAL AFFILIATIONS

Tau Beta Pi Engineering Honorary  
Society of Women Engineers

**Appendix B**  
**Interviewee Information**

Massachusetts Air National Guard  
Barnes Municipal Airport  
Westfield, Massachusetts

INTERVIEWEE INFORMATION

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Interviewee Number	Primary Duty Assignment	Years Associated With Barnes MAP
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1	Civil Engineering	33
2	POL Management	34
3	POL Management	13
4	Facilities Maintenance	29
5	Facilities Maintenance	29
6	Facilities Maintenance	29
7	Civil Engineering	21
8	Facilities Management	26
9	Building Custodian	14
10	Building Custodian	19
11	Motor Pool	39
12	Flight Line	33
13	Flight Line	23
14	Aerospace Systems	34
15	Fire Department	36
16	Airport Management	7

**Appendix C**  
**Outside Agency Contact List**

## OUTSIDE AGENCY CONTACT LIST

1. National Oceanic and Atmospheric Administration  
6001 Executive Boulevard  
Rockville, Maryland 21082
2. United States Geological Survey  
12201 Sunrise Valley Drive  
Reston, Virginia 22092
3. Westfield City Water Department  
Westfield, Massachusetts 01085
4. Division of Fisheries and Wildlife  
100 Cambridge Street  
Boston, Massachusetts 02202

**Appendix D**  
**USAF Hazard Assessment**  
**Rating Methodology**

## USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Preliminary Assessment phase of its Installation Restoration Program (IRP).

### PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-on site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

### DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contamination migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows:  $\text{receptors subscore} = (100 \times \text{factor score subtotal} / \text{maximum score subtotal})$ .

The waste characteristics category is scored in three stages. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways: surface-water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factory to the sum of the scores for the other three categories.

## HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE \_\_\_\_\_

LOCATION \_\_\_\_\_

DATE OF OPERATION OR OCCURRENCE \_\_\_\_\_

OWNER/OPERATOR \_\_\_\_\_

COMMENTS/DESCRIPTION \_\_\_\_\_

SITE RATED BY \_\_\_\_\_

## 1. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to installation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		

Subtotals \_\_\_\_\_

Receptors subscore (100 X factor score subtotal/maximum score subtotal) \_\_\_\_\_

## 11. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) \_\_\_\_\_

2. Confidence level (C = confirmed, S = suspected) \_\_\_\_\_

3. Hazard rating (H = high, M = medium, L = low) \_\_\_\_\_

Factor Subscore A (from 20 to 100 based on factor score matrix) \_\_\_\_\_

B. Apply persistence factor

Factor Subscore A X Persistence Factor = Subscore B

\_\_\_\_\_ X \_\_\_\_\_ = \_\_\_\_\_

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

\_\_\_\_\_ X \_\_\_\_\_ = \_\_\_\_\_

**III. PATHWAYS**

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subcore of 100 points for direct evidence or 30 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
				Subscore _____
B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water		3		
Net precipitation		6		
Surface erosion		3		
Surface permeability		6		
Rainfall intensity		3		
Subtotals				_____
Subscore (100 X factor score subtotal/maximum score subtotal)				_____
2. Flooding				
		1		
Subscore (100 X factor score/3)				_____
3. Ground water migration				
Depth to ground water		3		
Net precipitation		6		
Soil permeability		3		
Subsurface flows		3		
Direct access to ground water		3		
Subtotals				_____
Subscore (100 X factor score subtotal/maximum score subtotal)				_____
C. Highest pathway subscore.				
Enter the highest subscore value from A, B-1, B-2 or B-3 above.				
Pathways Subscore				_____

**IV. WASTE MANAGEMENT PRACTICES**

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	_____
Waste Characteristics	_____
Pathways	_____
Total _____ divided by 3 =	_____
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

## HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

## 1. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels				Multiplier
	0	1	2	3	
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to Installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; protected areas; presence or economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge areas major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, Industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

# 11. WASTE CHARACTERISTICS

## A-1 Hazardous Waste Quantity

- S = Small quantity (5 tons or 20 drums of liquid)  
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)  
L = Large quantity (20 tons or 85 drums of liquid)

## A-2 Confidence Level of Information

- C = Confirmed confidence level (minimum criteria below)  
o Verbal reports from interviewer (at least 2) or written information from the records  
o Knowledge of types and quantities of wastes generated by shops and other areas on base  
S = Suspected confidence level  
o No verbal reports or conflicting verbal reports and no written information from the records  
Logic based on the knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

## A-3 Hazard Rating

	Rating Scale Levels		
	0	1	2
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2
Ignitability	Flash point greater than 200° F	Flash point at 140° F to 200° F	Flash point at 80° F to 140° F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels
			Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

<u>Hazard Rating</u>	<u>Points</u>
High (H)	3
Medium (M)	2
Low (L)	1

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	M
80	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating

- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCH + SCH = LCH if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCH designation (60 points). By adding the quantities of each waste, the designation may change to LCH (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Multiply Point Rating Persistence Criteria	From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total from Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

### III. PATHWAYS CATEGORY

#### A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

#### B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels				Multiplier
	0	1	2	3	
Distance to nearest surface water (including drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay (>10 <sup>-2</sup> cm/sec)	15% to 30% clay (10 <sup>-2</sup> to 10 <sup>-4</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall (Number of thunderstorms)	<1.0 inch (0-5)	1.0 to 2.0 inches (6-35)	2.1 to 3.0 inches (36-49)	>3.0 inches (>50)	8

#### B-2 Potential for Flooding

Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1
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B-3 Potential for Ground-Water Contamination					
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	8
Soil permeability	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	15% to 30% clay (10 <sup>-2</sup> to 10 <sup>-4</sup> cm/sec)	0% to 15% clay (>10 <sup>-2</sup> cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8

Rating Factors	Rating Scale Levels			Multiplier
	0	1	2	3
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk
				8

#### IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

#### B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

##### Waste Management Practice

	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

##### Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

##### Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

##### Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

##### Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-6-3, then leave blank for calculation of factor score and maximum possible score.

**Appendix E**  
**Site Hazardous Assessment**  
**Rating Forms and**  
**Factor Rating Criteria**

104th Tactical Fighter Group  
Massachusetts Air National Guard  
Barnes Municipal Airport  
Westfield, Massachusetts

USAF HAZARD ASSESSMENT RATING METHODOLOGY  
FACTOR RATING CRITERIA

1. RECEPTORS

Population within 1,000 feet of site:	Approximately 25
Distance to nearest well:	Approximately 1 mile
Land use/zoning within 1 mile radius:	Industrial/Residential
Distance to installation boundary:	
Site No. 1	Outside Base Boundary
Site No. 2	Less than 100 feet
Site No. 3	Less than 100 feet
Site No. 4	Less than 100 feet
Site No. 5	Less than 100 feet
Critical environments within 1 mile:	Natural Areas/Minor
Water Quality of nearest surface water body:	Recreation
Groundwater use of uppermost aquifer:	Drinking (Limited use)
Population served by surface water supply within 3 miles downstream of site:	0
Population served by groundwater supply within 3 miles of site:	More than 1,000

2. WASTE CHARACTERISTICS

Quantity

Site No. 1	Approximately 20,000 gallons
Site No. 2	Approximately 500 gallons
Site No. 3	Approximately 100 gallons
Site No. 4	Approximately 100 gallons
Site No. 5	Approximately 100 gallons

Confidence Level

Site No. 1	Confirmed
Site No. 2	Confirmed
Site No. 3	Confirmed
Site No. 4	Confirmed
Site No. 5	Confirmed

104th Tactical Fighter Group  
Massachusetts Air National Guard  
Barnes Municipal Airport  
Westfield, Massachusetts

USAF HAZARD ASSESSMENT RATING METHODOLOGY  
FACTOR RATING CRITERIA (Continued)

2. WASTE CHARACTERISTICS (Continued)

Hazard Rating

Site No. 1	Medium
Site No. 2	Medium
Site No. 3	Medium
Site No. 4	Medium
Site No. 5	Medium

3. PATHWAYS

Surface Water Migration

Distance to nearest surface water:	About 520 feet
Net precipitation:	+ 20 inches
Surface erosion	Slight
Surface permeability:	$>10^{-2}$ cm/sec
Rainfall intensity:	2.50 inches

Flooding:	Beyond 100-year floodplain
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Groundwater Migration

Depth to groundwater:	18 feet
Net precipitation:	+ 20 inches
Soil permeability:	$>10^{-2}$ cm/sec
Subsurface flow:	Bottom of site greater than 5 feet above high groundwater level
Direct access to groundwater:	No evidence of risk

# HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE SITE NO. 1 - FIRE TRAINING AREA  
 LOCATION BARNES MUNICIPAL AIRPORT, WESTFIELD, MASSACHUSETTS  
 DATE OF OPERATION/OCCURRENCE 1950S TO AUGUST 1987  
 OWNER/OPERATOR MASSACHUSETTS AIR NATIONAL GUARD  
 COMMENTS/DESCRIPTION PREVIOUS SITE DESIGNATED FOR FIRE TRAINING EXERCISES  
 RATED BY HNTC

## I. RECEPTORS

RATING FACTOR	FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	1	4	4	12
B. DISTANCE TO NEAREST WELL	2	10	20	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	3	3	9	9
D. DISTANCE TO INSTALLATION BOUNDARY	3	6	18	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	2	10	20	30
F. WATER QUALITY OF NEAREST SURFACE WATER	1	6	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	2	9	18	27
H. POPULATION (WITHIN 3 MILES) SERVED BY				
DOWN STREAM SURFACE WATER	0	6	0	18
GROUND WATER	3	6	18	18
SUBTOTALS			113	180

RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL) 63

## II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) ( L )
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) ( C )
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) ( M )

FACTOR SUBSCORE A ( 80 )  
 <FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX>

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR SUBSCORE B  
 ( 80 ) ( 1 ) = ( 80 )

C. APPLY PHYSICAL STATE MULTIPLIER

PHYSICAL STATE  
 SUBSCORE B x MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE  
 ( 80 ) ( 1 ) = ( 80 )

### III. PATHWAY

RATING FACTOR	FACTOR RATING	MLTPLR	FACTOR SCORE	MAX. POSSIBLE SCORE
A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF <100 POINTS FOR DIRECT EVIDENCE> OR <80 POINTS FOR INDIRECT EVIDENCE>. IF DIRECT EVIDENCE <100> EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE <LESS THEN 80> EXISTS, PROCEED TO B ( 0 )				

B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.

#### 1. SURFACE WATER MIGRATION

DISTANCE TO NEAREST SURFACE WATER	:	2	8	16	24
NET PRECIPITATION	:	2	6	12	18
SURFACE EROSION	:	1	8	8	24
SURFACE PERMEABILITY	:	0	6	0	18
RAINFALL INTENSITY	:	2	8	16	24

SUBTOTALS				52	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					48

2. FLOODING		0	1	0	3
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SUBSCORE (100 x FACTOR SCORE /3)	:				0
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#### 3. GROUND WATER MIGRATION

DEPTH TO GROUND WATER	:	2	8	16	24
NET PRECIPITATION	:	2	6	12	18
SOIL PERMEABILITY	:	3	8	24	24
SUBSURFACE FLOWS	:	0	8	0	24
DIRECT ACCESS TO GROUND WATER	:	0	8	0	24

SUBTOTALS				52	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					46

#### C. HIGHEST PATHWAY SUBSCORE

ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE.  
( 48 )

### IV. WASTE MANAGEMENT PRACTICES

A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	( 63 )
WASTE CHARACTERISTICS	( 80 )
PATHWAYS	( 48 )
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	( 64 )

B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

GROSS TOTAL SCORE x	WASTE MANAGEMENT PRACTICES FACTOR	FINAL SCORE
( 64 ) ( 1 )	x	= 64
=====		

## HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE SITE NO. 2 - TANK SLUDGE DISPOSAL AREA  
 LOCATION BARNES MUNICIPAL AIRPORT, WESTFIELD, MASSACHUSETTS  
 DATE OF OPERATION/OCCURRENCE APPROXIMATELY 1950 TO 1960  
 OWNER/OPERATOR MASSACHUSETTS AIR NATIONAL GUARD  
 COMMENTS/DESCRIPTION DISPOSAL AREA OF TANK SLUDGES  
 RATED BY HNTC

## I. RECEPTORS

RATING FACTOR	FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	1	4	12
B. DISTANCE TO NEAREST WELL	:	2	10	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	2	10	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	2	9	27
H. POPULATION (WITHIN 3 MILES) SERVED BY DOWN STREAM SURFACE WATER	:	0	6	18
GROUND WATER	:	3	6	18
SUBTOTALS			113	180
RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				63

## II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) ( S )
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) ( C )
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) ( M )

FACTOR SUBSCORE A ( 50 )  
 <FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX>

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR SUBSCORE B  
 ( 50 ) ( 1 ) = ( 50 )

C. APPLY PHYSICAL STATE MULTIPLIER

PHYSICAL STATE  
 SUBSCORE B x MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE  
 ( 50 ) ( 1 ) = ( 50 )

### III. PATHWAY

RATING FACTOR	FACTOR RATING	MLTPLR	FACTOR SCORE	MAX. POSSIBLE SCORE
A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF <100 POINTS FOR DIRECT EVIDENCE> OR <80 POINTS FOR INDIRECT EVIDENCE>. IF DIRECT EVIDENCE <100> EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE <LESS THEN 80> EXISTS, PROCEED TO B ( 0 )				
B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.				
1. SURFACE WATER MIGRATION				
DISTANCE TO NEAREST SURFACE WATER :	2	8	16	24
NET PRECIPITATION :	2	6	12	18
SURFACE EROSION :	1	8	8	24
SURFACE PERMEABILITY :	0	6	0	18
RAINFALL INTENSITY :	2	8	16	24
SUBTOTALS			52	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				48
2. FLOODING				
	0	1	0	3
SUBSCORE (100 x FACTOR SCORE /3)				0
3. GROUND WATER MIGRATION				
DEPTH TO GROUND WATER :	2	8	16	24
NET PRECIPITATION :	2	6	12	18
SOIL PERMEABILITY :	3	8	24	24
SUBSURFACE FLOWS :	0	8	0	24
DIRECT ACCESS TO GROUND WATER :	0	8	0	24
SUBTOTALS			52	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				46
C. HIGHEST PATHWAY SUBSCORE				
ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE. ( 48 )				

### IV. WASTE MANAGEMENT PRACTICES

#### A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	( 63 )
WASTE CHARACTERISTICS	( 50 )
PATHWAYS	( 48 )
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	( 54 )

#### B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

WASTE MANAGEMENT		
GROSS TOTAL SCORE x	PRACTICES FACTOR x	FINAL SCORE
( 54 )	( 1 )	= 54
=====		

## HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE SITE NO. 3 - MOTOR POOL EXCAVATION AREA  
 LOCATION BARNES MUNICIPAL AIRPORT, WESTFIELD, MASSACHUSETTS  
 DATE OF OPERATION/OCCURRENCE AUGUST 1987  
 OWNER/OPERATOR MASSACHUSETTS AIR NATIONAL GUARD  
 COMMENTS/DESCRIPTION EXCAVATED DISPOSAL AREA  
 RATED BY HMTG

## I. RECEPTORS

RATING FACTOR	FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	1	4	12
B. DISTANCE TO NEAREST WELL	:	2	10	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	2	10	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	2	9	27
H. POPULATION (WITHIN 3 MILES) SERVED BY				
DOWN STREAM SURFACE WATER	:	0	6	18
GROUND WATER	:	3	6	18
SUBTOTALS			113	180
RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				63

## II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) ( S )
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) ( C )
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) ( M )

FACTOR SUBSCORE A ( 50 )

<FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX>

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR SUBSCORE B  
 ( 50 )( 1 ) = ( 50 )

C. APPLY PHYSICAL STATE MULTIPLIER

PHYSICAL STATE  
 SUBSCORE B x MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE  
 ( 50 )( 1 ) = ( 50 )

### III. PATHWAY

RATING FACTOR	FACTOR RATING	MULTPLR	FACTOR SCORE	MAX. POSSIBLE SCORE
A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF <100 POINTS FOR DIRECT EVIDENCE> OR <80 POINTS FOR INDIRECT EVIDENCE>. IF DIRECT EVIDENCE <100> EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE <LESS THEN 80> EXISTS, PROCEED TO B				
( 0 )				
B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.				
1. SURFACE WATER MIGRATION				
DISTANCE TO NEAREST SURFACE WATER :	2		16	24
NET PRECIPITATION :	2		12	18
SURFACE EROSION :	1		8	24
SURFACE PERMEABILITY :	0		0	18
RAINFALL INTENSITY :	2		16	24
SUBTOTALS			52	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				48
2. FLOODING				
	0		0	3
SUBSCORE (100 x FACTOR SCORE /3) :				0
3. GROUND WATER MIGRATION				
DEPTH TO GROUND WATER :	2		16	24
NET PRECIPITATION :	2		12	18
SOIL PERMEABILITY :	3		24	24
SUBSURFACE FLOWS :	0		0	24
DIRECT ACCESS TO GROUND WATER :	0		0	24
SUBTOTALS			52	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				46
C. HIGHEST PATHWAY SUBSCORE				
ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE.				
( 48 )				

### IV. WASTE MANAGEMENT PRACTICES

A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	( 63 )
WASTE CHARACTERISTICS	( 50 )
PATHWAYS	( 48 )
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	( 54 )

B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

	WASTE MANAGEMENT	
GROSS TOTAL SCORE x	PRACTICES FACTOR x	FINAL SCORE
( 54 )	( 1 )	= 54
		=====

# HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE SITE NO. 4 - STORM WATER RETENTION POND  
 LOCATION BARNES MUNICIPAL AIRPORT, WESTFIELD, MASSACHUSETTS  
 DATE OF OPERATION/OCCURRENCE APPROXIMATELY 1961  
 OWNER/OPERATOR MASSACHUSETTS AIR NATIONAL GUARD  
 COMMENTS/DESCRIPTION SITE OF 100 GALLON JP-4 JET FUEL SPILL  
 RATED BY HNTC

## I. RECEPTORS

RATING FACTOR	FACTOR		MAXIMUM	
	RATING	MULTIPLIER	FACTOR SCORE	POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	1	4	12
B. DISTANCE TO NEAREST WELL	:	2	10	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	2	10	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	2	9	27
H. POPULATION (WITHIN 3 MILES) SERVED BY				
DOWN STREAM SURFACE WATER	:	0	6	18
GROUND WATER	:	3	6	18
SUBTOTALS			113	180

RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)

63

## II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) ( S )
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) ( C )
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) ( M )

FACTOR SUBSCORE A ( 50 )

<FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX>

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR SUBSCORE B  
 ( 50 )( 1 ) = ( 50 )

C. APPLY PHYSICAL STATE MULTIPLIER

PHYSICAL STATE  
 SUBSCORE B x MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE  
 ( 50 )( 1 ) = ( 50 )

### III. PATHWAY

RATING FACTOR	FACTOR RATING	MLTPLR	FACTOR SCORE	MAX. POSSIBLE SCORE
A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF <100 POINTS FOR DIRECT EVIDENCE> OR <80 POINTS FOR INDIRECT EVIDENCE>. IF DIRECT EVIDENCE <100> EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE <LESS THEN 80> EXISTS, PROCEED TO B ( 0 )				
B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.				
1. SURFACE WATER MIGRATION				
DISTANCE TO NEAREST SURFACE WATER :	3	8	24	24
NET PRECIPITATION :	2	6	12	18
SURFACE EROSION :	1	8	8	24
SURFACE PERMEABILITY :	0	6	0	18
RAINFALL INTENSITY :	2	8	16	24
SUBTOTALS			60	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				56
2. FLOODING				
	0	1	0	3
SUBSCORE (100 x FACTOR SCORE /3) :				0
3. GROUND WATER MIGRATION				
DEPTH TO GROUND WATER :	2	8	16	24
NET PRECIPITATION :	2	6	12	18
SOIL PERMEABILITY :	3	8	24	24
SUBSURFACE FLOWS :	0	8	0	24
DIRECT ACCESS TO GROUND WATER :	0	8	0	24
SUBTOTALS			52	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				46
C. HIGHEST PATHWAY SUBSCORE				
ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE. ( 56 )				

### IV. WASTE MANAGEMENT PRACTICES

#### A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	( 63 )
WASTE CHARACTERISTICS	( 50 )
PATHWAYS	( 56 )
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	( 56 )

#### B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

GROSS TOTAL SCORE x	WASTE MANAGEMENT PRACTICES FACTOR x	FINAL SCORE
( 56 )	( 1 )	= 56
		=====

## HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE SITE NO. 5 - ORIGINAL AIRCRAFT MAINTENANCE AREA/GRASSY SWALE  
 LOCATION BARNES MUNICIPAL AIRPORT, WESTFIELD, MASSACHUSETTS  
 DATE OF OPERATION/OCCURRENCE APPROXIMATELY 1963  
 OWNER/OPERATOR MASSACHUSETTS AIR NATIONAL GUARD  
 COMMENTS/DESCRIPTION SITE OF 100 GALLON JP-4 JET FUEL SPILL  
 RATED BY HNTC

## I. RECEPTORS

RATING FACTOR	FACTOR		MAXIMUM	
	RATING	MULTIPLIER	FACTOR SCORE	POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	1	4	12
B. DISTANCE TO NEAREST WELL	:	2	10	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	2	10	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	2	9	27
H. POPULATION (WITHIN 3 MILES) SERVED BY				
DOWN STREAM SURFACE WATER	:	0	6	18
GROUND WATER	:	3	6	18
SUBTOTALS			113	180

RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)

63

## II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) ( S )
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) ( C )
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) ( M )

FACTOR SUBSCORE A ( 50 )

<FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX>

## B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR SUBSCORE B  
 ( 50 )( 1 ) = ( 50 )

## C. APPLY PHYSICAL STATE MULTIPLIER

PHYSICAL STATE  
 SUBSCORE B x MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE  
 ( 50 )( 1 ) = ( 50 )

### III. PATHWAY

RATING FACTOR	FACTOR RATING	MLTPLR	FACTOR SCORE	MAX. POSSIBLE SCORE
A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF <100 POINTS FOR DIRECT EVIDENCE> OR <80 POINTS FOR INDIRECT EVIDENCE>. IF DIRECT EVIDENCE <100> EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE <LESS THEN 80> EXISTS, PROCEED TO B ( 0 )				
B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.				
1. SURFACE WATER MIGRATION				
DISTANCE TO NEAREST SURFACE WATER :	3	8	24	24
NET PRECIPITATION :	2	6	12	18
SURFACE EROSION :	1	8	8	24
SURFACE PERMEABILITY :	0	6	0	18
RAINFALL INTENSITY :	2	8	16	24
SUBTOTALS			60	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				56
2. FLOODING				
	0	1	0	3
SUBSCORE (100 x FACTOR SCORE /3)				0
3. GROUND WATER MIGRATION				
DEPTH TO GROUND WATER :	2	8	16	24
NET PRECIPITATION :	2	6	12	18
SOIL PERMEABILITY :	3	8	24	24
SUBSURFACE FLOWS :	0	8	0	24
DIRECT ACCESS TO GROUND WATER :	0	8	0	24
SUBTOTALS			52	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)				46
C. HIGHEST PATHWAY SUBSCORE				
ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE. ( 56 )				

### IV. WASTE MANAGEMENT PRACTICES

#### A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	( 63 )
WASTE CHARACTERISTICS	( 50 )
PATHWAYS	( 56 )
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	( 56 )

#### B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

WASTE MANAGEMENT		
GROSS TOTAL SCORE x	PRACTICES FACTOR x	FINAL SCORE
( 56 )	( 1 )	= 56
=====		